final report

Murphy Creek Hydroelectric Project

Forestry Studies

for
B. C. Hydro & Power Authority

June, 1981

revised
January, 1984

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Canadian Cataloguing in Publication Data

Main entry under title:
Murphy Creek Hydroelectric Project : forestry studies

At head of title: Final report.
Originally prepared 1981.
ISBN 0-7726-0027-9

1. Forests and forestry - British Columbia - Kootenay Boundary. 2. Forests and forestry - British Columbia - Central Kootenay. 3. Columbia River - Power utilization - Environmental aspects - British Columbia - Kootenay Boundary. 4. Columbia River - Power utilization - Environmental aspects - British Columbia - Central Kootenay. 5. Murphy Creek Project. I. B.C. Hydro. II. Talisman Land Resource Consultants. III. Title: Forestry studies.

SD146.B7M87 1984 333.75'1'0971144 C84-092088-1

B.C. HYDRO

This impact assessment is based on the "Murphy Creek Project Engineering Description" prepared in November 1982. Since that time, ongoing planning and design studies have resulted in some changes that would affect the project description. The principal changes are as follows:

- In-service date has changed from 1993 to 1995.

- Installed capacity has changed from 300 MW to 275 MW.

- Small changes to the design and locations of shoreline protective works.

- Daily reservoir level fluctuations limited to 2.0 m during March, April and May (previously March and April).

The above changes have been incorporated in the report only where they would affect the results of the impact assessment.

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SUMMARY: FORESTRY STUDIES

FOREST RESOURCES

Although most of the study area is well suited to timber production, very little of the area is under forest cover and even less supports mature stands of commercial trees. Moreover, the area represents an insignificant portion of the region's actual or potential timber supply, with little or no supply arising within the study area at present. Most of the scattered occurrences of mature and immature forest cover found in the study area are on private land, as most of the study area below EL 500 m is alienated from the Crown. Very few of these lands are managed for growing timber. The few areas of mature and immature forest cover that occur on Crown lands in the study area make an insignificant contribution to the allowable cut in the region.

While most of the study area does have moderate forest capability, existing land tenure patterns make any future realization of this capability potential very unlikely.

SUMMARY: FORESTRY STUDIES

FOREST USE AND ACTIVITY

Little or no logging is carried out in the study area. The only forest industry activity found in the area consists of the B.C. Timber Ltd.'s pulpmill and sawmill west of Castlegar. This mill secures its timber supply from outside the study area.

Currently there are no Crown forest tenures within the study area.

INVENTORY OF STUDY AREA FORESTRY

Most of the study area's lands, estimated to total about 4,468 ha, consist of sites with moderate forest capability. About 90% of the area falls within BCLI Forest Capability Classes 3 and 4. The inventory revealed no Class 1 sites and only 14 ha were classified within Class 2.

Although 90% of the land in the study area is well suited to timber production, less than 10% of the area presently supports even marginally commercial forest cover. A total of only 423 ha is considered potentially commercial and of this only 77 ha is mature timber with any immediate exploitation potential. Although some potential does exist in a few areas for intensive forest management, little or no timber management is apparent in any part of the study area.

Table S.1 provides a summary of the forest capability and present forest cover of study area lands.

Table S.1

SUMMARY OF STUDY AREA FOREST RESOURCES

Study Area Lands by Present Forest Cover

COVER TYPE	AREA (ha)	% STUDY AREA (4468 ha total)
Mature	77	2
Immature	346	8
Non-forest	4045	91
TOTAL	4468	100

Study Area Lands by Forest Capability

CAPABILITY CLASS	AREA (ha)	% STUDY AREA (4468 ha total)
2	14	< 1
3	1586	35
4	2468	55
5	132	3
6	153	3
7	115	3
TOTAL	4468	100

SUMMARY: FORESTRY STUDIES

POSSIBLE PROJECT IMPACTS ON FORESTRY

Table S.2 summarizes possible project impacts on existing forest cover. While some areas of forest cover are affected at all three reservoir levels considered (the proposed reservoir level of EL 424 m and the two higher reservoir levels initially assessed in the environmental studies), only a few areas have potentially merchantable stands. Nearly all of the areas are privately held lands which are not being managed for timber production.

Land areas that would be inundated at the three reservoir levels, by BCLI forest capability class, are summarized for the study area in Table S.3. Class 4 lands comprise most of the potential inundation at all reservoir levels considered, followed by Class 3 lands. A total of 301 ha would be inundated at the proposed EL 424 m reservoir level.

Only a small part of the area under any of the three reservoir levels is presently occupied by forest cover and most of these stands are not adequately stocked with potentially commercial trees. None of the lands appear to be managed for timber production and existing land ownership patterns seem to dictate strongly against the forest resource potential of these lands ever being realized. Therefore it would be misleading to assess impacts on the basis of BCLI forest capability. Although the potential for timber production exists for much of the area potentially inundated, it is not in fact being realized at present and it does not appear that this will change in the future in the absence of the project.

Table S.2

SUMMARY OF FOREST COVER INUNDATED AT THREE POSSIBLE RESERVOIR LEVELS[a,b]

SUB-AREA		River to 424 m a.s.l.		424-427 m a.s.l.		427-430 m a.s.l.		TOTALS	
NO.	NAME	Volume (m^3)	Area (ha)	Volume (m^3)	Area (ha)	Volume (m^3)	Area (ha)	Volume (m^3)	Area (ha)
1	Columbia River North	10	0.2	10	0.2	20	0.4	40	0.8
2	Columbia River South	6	0.04	5	0.03	3	0.02	14	0.09
3	Pass Creek	200	1.0	-	-	-	-	200	1.0
4	Kootenay River	-	-	-	-	-	-	-	-
5	Castlegar-Kinnaird	-	-	300	2.5	220	3.0	520	5.5
6	Castlegar Airport	-	-	-	-	-	-	-	-
7	Champion and Jordan Creeks	490	4.4	290	2.8	80	0.8	860	8.0
8	Blueberry Creek - Genelle	-	-	-	-	-	-	-	-
9	Billy Creek	40	7.2	4	0.6	1	0.2	45	8.0
10	Oasis	-	-	-	-	-	-	-	-
SUBTOTALS		746	12.8	609	6.1	324	4.4	1679	23.3
CUMULATIVE TOTAL		746	12.8	1355	18.9	1679	23.3		

[a]Volume estimates are net volumes at close utilization standards, less decay.

[b]EL 424 m and EL 430 m are no longer being considered, but are presented to illustrate comparative losses at the three reservoir operating levels initially assessed in the environmental studies.

Table S.3

STUDY AREA SUMMARY

Areas of Forest Capability Types Inundated
at Three Possible Reservoir Levels[a]
(Hectares)

BCLI FOREST CAPABILITY CLASS	River to 424 m a.s.l.	424-427 m a.s.l.	CUMULATIVE TOTAL	427-430 m a.s.l.	TOTAL
1	-	-	-	-	-
2	-	-	-	-	-
3	37.0	63.0	100.0	68.0	168.0
4	182.0	97.0	279.0	91.0	370.0
5	2.0	1.0	3.0	2.0	5.0
6	33.0	0.5	33.5	2.5	36.0
7	47.0	2.0	49.0	0.5	49.5
TOTAL	301.0	163.5	464.5	164.0	628.5

[a]EL 424 m and EL 430 m are no longer being considered, but are presented to illustrate comparative losses at the three reservoir operating levels initially assessed in the environmental studies.

SUMMARY: FORESTRY STUDIES

FORESTRY IMPACT EVALUATION

At the proposed reservoir level of EL 424 m, all the potentially affected areas capable of sustained forest production have a potential present value of $45,000 for timber production. However, if this potential value were to be realized it would require all of these areas to be managed for timber production. Since most, if not all, lands in the study area are not in fact presently managed and are not expected to be in the future, this valuation substantially overstates the project's actual impact on the study area's forestry potential. In the 1980 Forest and Range Analysis Technical Report (BCMF, 1980), lands in the study area are projected to be entirely unavailable for timber harvesting. Since lands affected by the project will not be available for timber production in the future, there should be no impact from the project on the study area's forestry potential.

REGIONAL IMPACTS

The 900 cubic metres per year of potential timber production that could occur if all areas potentially affected at the proposed reservoir level of 424 m were managed for timber production represents, at best, less than one-third of one percent of the regional annual allowable cut (AAC), although it could constitute a large proportion of the annual wood requirements for some smaller mills in the region.

The maximum potential timber production of 60 cubic metres that would be lost from only those areas currently under forest cover that would be affected by the proposed project, represents an even smaller percentage of the regional AAC, although it may be significant to some small logging operations or mills, given the projected timber deficit for the region.

As stated in the previous section, these possible impacts are hypothetical, since they would only occur if these lands were to be managed for timber production in the absence of the project. Such a situation is considered unlikely.

MITIGATION OPPORTUNITIES

With respect to the standing timber that would be lost if the project proceeds, commercial logging of the reservoir area does not appear to be an appropiate mitigation measure. However, clearing of the reservoir may be desirable from alternate viewpoints.

Selling or giving away firewood to local residents could be considered. Firewood could be cut from some of the few mixed stands of white birch, lodgepole pine, western larch and Douglas-fir which are scattered in the reservoir areas. No precise estimate of the amount of firewood which could be cut has been made, however the maximum amount is roughly estimated to be 100 cords at the proposed EL 424 m reservoir level.

CHAPTER 1

INTRODUCTION

This study arose in response to a request, dated March 13, 1980, by the Generation Planning Department of B.C. Hydro for proposals to carry out the forestry component of the detailed feasibility assessment of the proposed Murphy Creek Hydro-electric Project. In a letter of confirmation, dated April 24, 1980, Talisman Land Resource Consultants were contracted to provide these services.

The Talisman consultant principally responsible for the forestry studies and impact assessment carried out in this project was Jace Standish, R.P.F. Paul Christie functioned as project director for all the environmental studies carried out by Talisman on the Murphy Creek Project. Mr. Standish is the principal author of this report, and Dan Schroeter, P.Ag., acted as editor.

The terms of reference for the forestry studies (see Appendix A) require both an inventory of the resources and industry of the study area and region, and an assessment of the short and long term impacts of the proposed project on present and future forestry activity. The terms of reference also called for identification of opportunities for mitigating any adverse impacts caused by the project.

INTRODUCTION

The forestry studies relate to the present utilization of timber resources, the operation of industrial sites in the study area, and the effects of the project on this activity. Also of interest are the effects of any reduction in the forest land base, due to the project, on future timber resource utilization in the immediate area and the region in general.

The study area for the forestry studies consists of all lands below elevation (EL) 500 metres above sea level (a.s.l.) adjacent to the Columbia and Kootenay Rivers and within the limit of the available photomosaic mapping, from immediately downstream of the proposed damsite near Oasis, B.C., upstream on the Columbia River to the Hugh Keenleyside Dam, and upstream on the Kootenay River to the Brilliant Dam (see Figure 1.1). The proposed till removal site located along Murphy Creek between EL 600 m and EL 800 m was also included in the study area.

To facilitate the understanding and use of this report, the detailed study area inventory and impact assessment that follows is presented by ten sub-areas, as well as for the total study area. The sub-areas, shown in Figure 1.1, are as follows:

Sub-Area 1: Columbia River North
(Hugh Keenleyside Dam to Robson)
Sub-Area 2: Columbia River South
(Hugh Keenleyside Dam to Castlegar)
Sub-Area 3: Pass Creek
Sub-Area 4: Kootenay River
Sub-Area 5: Castlegar - Kinnaird
Sub-Area 6: Castlegar Airport
Sub-Area 7: Champion and Jordan Creeks
Sub-Area 8: Blueberry Creek - Genelle
Sub-Area 9: Billy Creek
Sub-Area 10: Oasis (including the Murphy Creek till site)

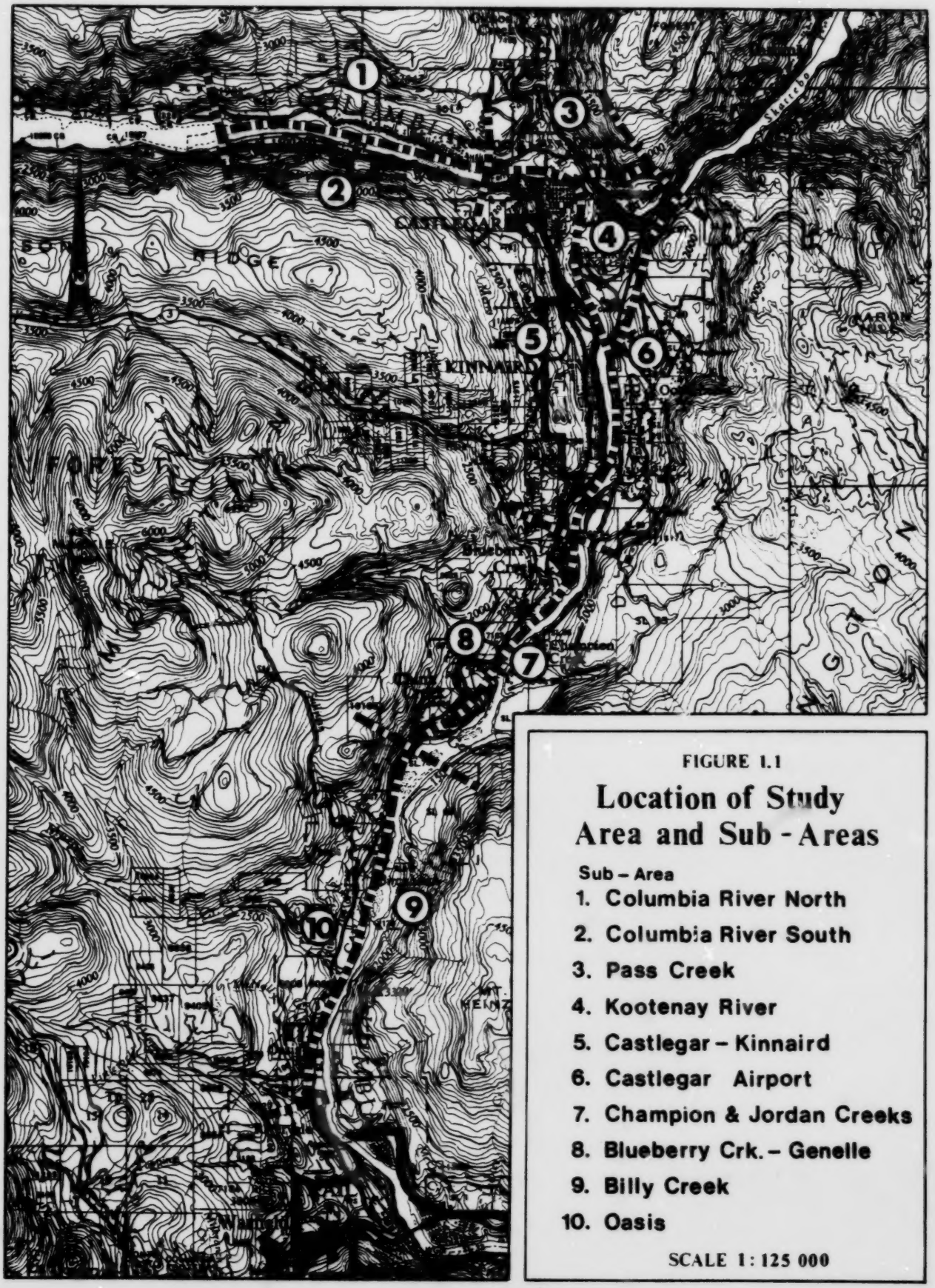


FIGURE 1.1

Location of Study Area and Sub - Areas

Sub – Area

1. Columbia River North
2. Columbia River South
3. Pass Creek
4. Kootenay River
5. Castlegar – Kinnaird
6. Castlegar Airport
7. Champion & Jordan Creeks
8. Blueberry Crk. – Genelle
9. Billy Creek
10. Oasis

SCALE 1 : 125 000

INTRODUCTION

The report that follows is the fifth draft of the Murphy Creek forestry studies and supercedes all previous drafts. This draft has been revised to incorporate responses to relevant review comments by B.C. Government and B.C. Hydro reviewers. The basis on which this report was written remains the program of field work and data compilation that was carried out in the summer of 1980. All present use information portrayed in the report is based on observed or documented use as of that date.

The following report is presented in three chapters. Chapter 2 provides a background description of regional forestry resources and use, Chapter 3 documents a detailed inventory description of study area forestry, and Chapter 4 presents an assessment of the possible impacts that the proposed hydroelectric project would have on future study area forestry activity. A set of appendices follows Chapter 4.

The reader is also referred to the Resource Atlas for this project prepared by Thurber Consultants Ltd. It contains the forestry mapping that was carried out in the inventory phase of these studies.

CHAPTER 2

REGIONAL FORESTRY OVERVIEW

FOREST RESOURCES

Biogeoclimatic Zones

Two forested biogeoclimatic zones occur in the region, the Interior Western Hemlock (IWH) and the Engelmann Spruce-Subalpine Fir (ESSF) Zones (Krajina, 1965 and 1969). The IWH extends from the valley bottoms to an average elevation of approximately 1250 metres a.s.l. From there, the ESSF extends to the treeless Alpine tundra biogeoclimatic zone at an average elevation of approximately 2250 metres a.s.l.

The IWH is the most productive zone in the interior of British Columbia (Krajina, 1969). Forest vegetation in this zone is described in detail in the Murphy Creek Project Vegetation Studies report. Major commercial tree species include western hemlock, western red cedar, western larch, Douglas-fir and lodgepole pine. Ponderosa pine, western white pine, grand fir, subalpine fir, Engelmann spruce, whitebark pine, white birch, trembling aspen and black cottonwood also occur.

The ESSF is dominated by Engelmann spruce, lodgepole pine and subalpine fir. Although the ESSF is less productive and

contains fewer species than the lower elevation IWH, because of its extent it is an important source of timber in the region. It should be noted that, because the study area for the forestry studies comprises lands under 500 metres elevation a.s.l., no part of the ESSF extends into the study area.

Timber Resources

Data from the most recent B.C. Ministry of Forests' (BCMF) inventory surveys for the Salmo Public Sustained Yield Unit (PSYU) can provide a representative perspective on the timber resources found in the region. The total area within the unit boundaries of the Salmo PSYU is 358,831 hectares (see Figure 2.1). Twenty-nine percent (103,861 hectares) of the land within the Salmo PSYU is alienated from the Crown (privately owned). It is estimated that sixty percent, or about 62,000 ha, of this private land is forested; approximately twenty percent of this forested area is covered with mature timber (greater than 120 years old) and the remaining eighty percent with immature stands of variable quality and species composition.

Much greater areas of timber are found on the Crown portions of the PSYU. Mature timber on Crown lands within the Salmo PSYU covers 29,276 hectares or eleven percent of the total area of Crown land. The corresponding total mature volume is 9,078,989 cubic metres[1]. In order of decreasing volume this is composed of the following species:

* spruce 28%
* balsam (grand fir and subalpine fir) 22%
* hemlock 13%

[1] 1976 data for mature timber 18 centimetres or greater in diameter breast height (Dbh), to close utilization standards, less decay.

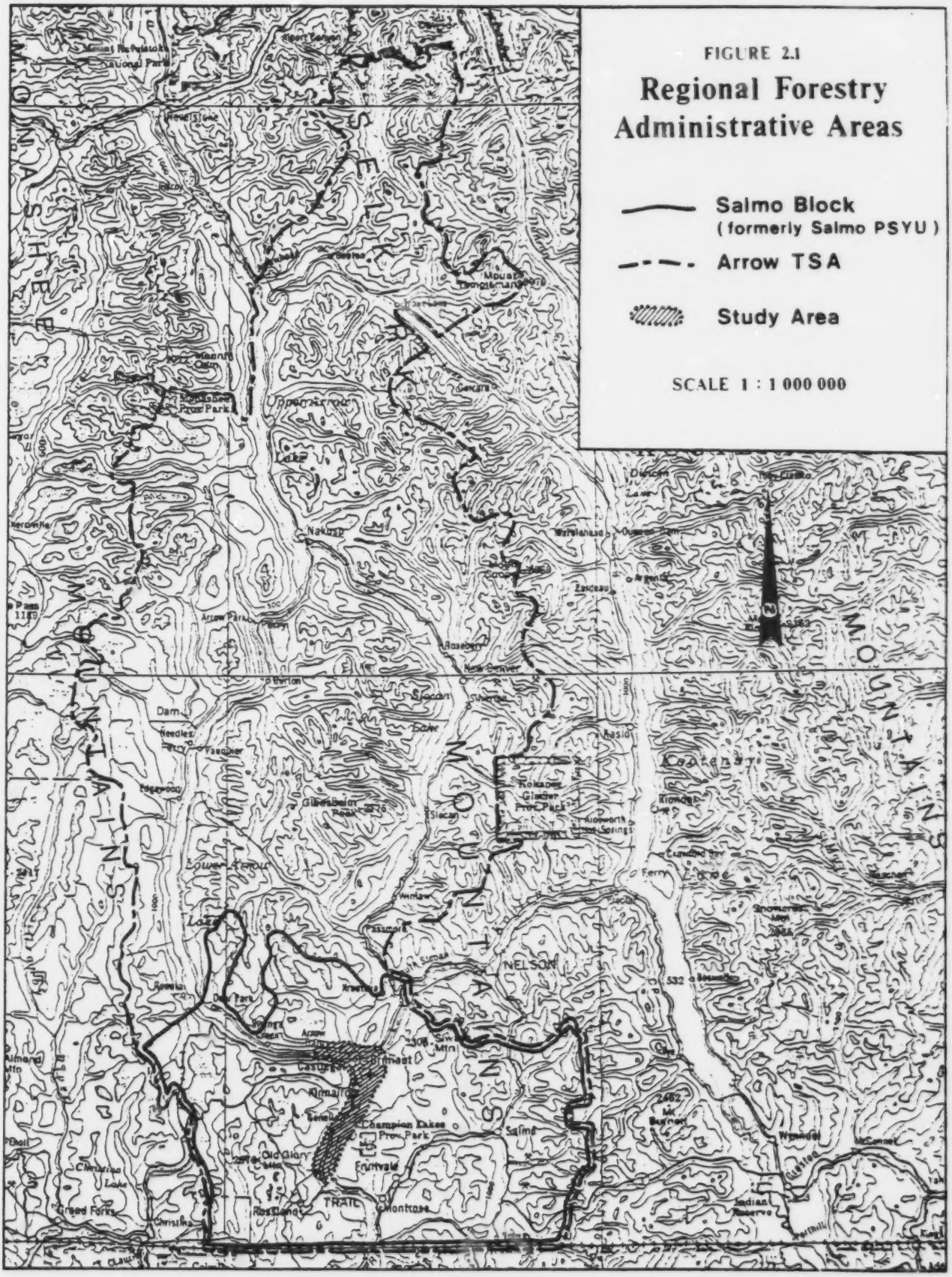


FIGURE 2.1
Regional Forestry
Administrative Areas
Salmo Block
(formerly Salmo PSYU)
Arrow TSA
Study Area
SCALE 1 : 1 000 000
SELKIRK MOUNTAINS
MONASHEE MOUNTAINS
PURCEL MOUNTAINS
COLUMBIA MOUNTAINS
NELSON
TRAIL

* lodgepole pine	11%
* fir (Douglas-fir)	9%
* cedar	8%
* larch	4.8%
* white pine	1.8%
* ponderosa pine	±0.3%
* white birch	±0.2%
* whitebark pine	±0.1%
* black cottonwood	±0.1%
* trembling aspen	±0.1%

The remaining area of Crown lands is classified as follows:

* immature forest	56%
* non-commercial forest	2%
* disturbed - stocking doubtful	1.2%
* not satisfactorily restocked	0.8%
* non-forest (alpine, water, swamp, rock, non-productive sites and roads)	29%

From B.C. Ministry of Forests' 1974 inventory data, the immature Crown forest area can be summarized according to the following stand age classes:

* 1 - 20 years	5.5%
* 21 - 40 years	22.0%
* 41 - 60 years	29.0%
* 61 - 80 years	21.5%
* 81 - 100 years	16.0%
* 101 - 120 years	6.0%

REGIONAL FORESTRY OVERVIEW

Crown forest land in the Salmo PSYU is composed of the following B.C. Ministry of Forests' site quality classes

* good sites	14%
* medium sites	60%
* poor sites	25%
* low sites	1%

In summary, several features of the regional timber resource can be noted. These are:

* the bulk of the timber resource is on Crown lands.
* most stands are in the 21-80 year age classes. Mature stands comprise only eleven percent of the Crown forest lands.
* major tree species, according to mature volume, are spruce, balsam, hemlock and lodgepole pine. Douglas-fir, cedar, larch, and white pine are less abundant. Ponderosa pine, white birch, whitebark pine, black cottonwood, and trembling aspen comprise a minor portion of the total mature volume.
* many stands have a diverse species composition.
* medium quality growing sites are most common.

FOREST USE

Past Use

The beginning of the forest industry in the region was associated with the period of railroad construction and mining development in the 1890's. The major forest products were mine timbers, railroad ties and lumber. Over the next twenty or more years the industry developed largely in a cyclical fashion

caused by changing market conditions and indiscriminate cutting practices. When the prairie lumber market collapsed in 1913, the industry entered a period of stagnation that persisted until after World War II. The improved general economic climate, along with improved transportation and an increased concern for the management of the province's timber resources, encouraged an expansion of the forest industry during the 1950's which has continued to the present.

While lumber continues to be a major forest product of the region, other important products now include veneer, plywood, chips, and kraft pulp. In 1961 the first pulpmill in south-eastern British Columbia was constructed by Columbia Cellulose Ltd. at Castlegar (now owned by B.C. Timber Ltd.). From 1960 to 1977 the production of logs and lumber in the Nelson Forest Region increased by more than two hundred percent while the number of operating sawmills decreased from 268 to 119 (B.C. Ministry of Forests, 1980) reflecting the province wide trend of expansion and consolidation in the industry.

Present Use and Tenure

The study region is within the unit boundaries of the Salmo Block (formerly the Salmo PSYU) of the Arrow Timber Supply Area (TSA) and is administered by the B.C. Ministry of Forests through the District Manager at Castlegar and the Regional Manager in Nelson (see Figure 2.1). As noted earlier in this chapter, Crown lands are the major source of timber supply and occupy approximately 71 percent of the area. Alienated lands are concentrated along the Columbia River Valley and tributary valleys.

There are eight major logging companies operating in the study region with a total allowable annual cut from Crown lands of

274,670 cubic metres. Logging operations are summarized in Table 2.1.

There are five sawmills operating in the study region. Their combined annual lumber production in 1979 was approximately 325 million board feet. Timber supplies for these mills are generally drawn from the Arrow TSA. Table 2.2 presents a summary of sawmills in the study region.

The B.C. Timber Ltd. pulpmill near Castlegar is the only pulpmill operating in the study region. The mill has an annual capacity of approximately 195,000 tonnes of kraft pulp and its estimated annual consumption is approximately 1 million cubic metres of equivalent roundwood consisting of 481,000 cubic metres of actual roundwood and 196,000 bone dry units of wood chips (1978 data from B.C. Ministry of Forests, 1980). The pulpmill's timber source derives from outside the study region, particularly from the Arrow Lakes Tree Farm License (TFL 23) held by Canadian Cellulose Co. Ltd.

Projected Use

The forest industry in the region is encountering the same conflicts between an increasing demand for timber and a shrinking land base for timber production as are occurring in many other regions of the province. Land alienation for settlement, industry, agriculture, highways, energy rights-of-way, storage reservoirs, and associated uses have considerably diminished the forest land base in past years. This process is projected to continue. At the same time, an increasing focus on the associated products and uses of forest land - watershed protec-

Table 2.1

SUMMARY OF LOGGING OPERATIONS IN THE STUDY REGION

COMPANY	ADDRESS	TOTAL ALLOWABLE ANNUAL CUT FROM CROWN LANDS (m^3)
Atco Lumber Ltd.	Box 369 Fruitvale, B.C. V0G 1L0	59,800
Glenmerry Sawmills Ltd.	Box 398 Trail, B.C. V1R 4L7	22,930
Hadikin Bros. Lumber Co. Ltd.[a]	Box 3337 Castlegar, B.C. V1N 3H6	35,760
Hearn Bros. Lumber Co. Ltd.	Box 369 Fruitvale, B.C. V0G 1L0	56,140
Kalesnikoff Lumbering Co. Ltd.	Box 3000 Thrums, B.C. V1N 3L4	28,330
Louisiana Pacific Canada Ltd.	Box 40 Salmo, B.C. V0G 1Z0	36,740
Northwood Properties Ltd.	c/o Weyerhaeuser Canada Ltd. Box 800 Kamloops, B.C. V2C 5M7	33,610
Pope and Talbot Ltd.	Box 70 Midway, B.C. V0H 1M0	1,360
TOTAL		274,670

Source: B.C. Ministry of Forests, Castlegar, B.C. (1979 data, as reported in the District Annual Report, Castlegar District, B.C. Ministry of Forests, 1980).

[a]The Hadikin Bros. Lumber Co. was operating during initial forestry and impact assessment studies. However, the company is reported to be inactive at the time of this report revision, January, 1984.

Table 2.2

SUMMARY OF SAWMILLS IN THE STUDY REGION

NAME OF MILL AND LOCATION	DAILY CONSUMPTION (m^3 per 8 hour shift)	EMPLOYEES (averages)	ESTIMATED ANNUAL LUMBER PRODUCTION (Mbm)	NET ANNUAL VOLUMES CONSUMED (m^3)
Jones Ties & Poles, Patterson	14	3	100	2,800
Drake Tie Mill, Rossland	11	3	80	2,240
B.C. Timber Ltd., Castlegar[a]	840	392	300,000	140,000
Hadikin Brothers Lumbering Limited, Brilliant[b]	182	45	14,000	42,000
Kalesnikoff Lumbering Company Limited, Thrums	140	41	11,000	35,000
TOTALS	1187	484	325,180	222,040

Source: B.C. Ministry of Forests, Castlegar, B.C. (estimates only, based on 1979 data, as reported in the District Annual Report, Castlegar District, B.C. Ministry of Forests, 1980).

[a]Formerly Canadian Cellulose

[b]Hadikin Bros. mill reported to be inactive in 1983 and 1984.

tion, recreation, fisheries, wildlife, grazing - has led to increased management requirements and reductions in potential maximum timber production. This trend is also projected to continue.

The long-run forecast for timber supply in the Nelson Forest Region is that present levels of timber consumption cannot be maintained (B.C. Ministry, of Forests, 1980). A deficit in the timber supply is predicted to occur in approximately seventy years. Cutting ages will be increasingly younger resulting in a reduction in individual tree size and quality. Within the study region the timber supply is particularly constricted (B.C. Ministry of Forests, 1980), and reductions in future cutting levels are likely.

CHAPTER 3

STUDY AREA FOREST RESOURCES

This chapter presents detailed descriptions of the forest resources and present forestry activity in each of the ten defined sub-areas of the study area.

In order to clarify differences in classification between this inventory discussion and the inventory of vegetation resources presented earlier, a discussion of classification methods used in the Forestry Studies is presented in the following section, and significant differences in classification perspectives between the Vegetation and Forestry Studies are discussed.

INVENTORY METHODS

Forest Cover and Cover Types

British Columbia Ministry of Forests' forest cover maps were updated from 1979 aerial photographs, interviews with BCMF district staff, and ground reconnaissance of the study area. For each sub-area, forest cover is summarized according to the

following general forest cover types:

* Mature: stands greater than 120 years old.

* Immature: stands 120 years old or less.

* Non-forest: including the not satisfactorily restocked, disturbed - stocking doubtful, non-commercial, cultivated and non-forest land categories used in the BCMF forest inventory mapping.

These three general types are helpful in showing the area and the proportion of land in each sub-area which is covered with stands that may presently be exploitable (mature), covered with stands that may be exploitable in the future (immature), and not covered with stands that are exploitable now or in the future (non-forest), unless reforestation or afforestation programs are carried out.

Classification Perspective

In order to avoid possible confusion, it is emphasized that the general forest cover types discussed in this chapter of the report may not seem congruent with some vegetation map types and descriptions. In vegetation mapping, forest vegetation can include any vegetation types which are dominated by woody plants greater than some more or less arbitrary height, for example, 4 metres. Foresters usually employ a different classification, with a bias to timber production.

Forest cover types contain specific information on species composition, stand age, height, and stocking for the purpose of identifying and managing stands which are presently or poten-

tially exploitable. Therefore map units which may be considered as forest vegetation on a vegetation map may be considered as non-forest on a forest cover map. For example, a map unit containing scattered cottonwood and western red cedar with a tall woody shrub layer of birch, hazelnut and willow might be mapped as a forest type on a vegetation map but would be considered as non-forest cover in the context of most forestry-oriented classifications. This is certainly the case with BCMF forest cover mapping.

Some other apparent anomalies between vegetation and forestry descriptions may arise from different definitions of the study area; the vegetation study area extends to an elevation of 800 metres a.s.l. while the forestry study area extends only to the 500 metre a.s.l. elevation. Vegetation mapping included some low-lying islands on gravel bars which were not included in the forestry mapping.

Forest Capability

Forest capability was mapped by modifying existing British Columbia Land Inventory (BCLI) forest capability maps of 1:50,000 scale. Forest capability was mapped at a 1:10,000 scale using 1979 aerial photographs. Original BCLI map units were modified on the basis of existing soil survey information, BCMF forest cover maps and forest inventory data, ground reconnaissance of soils and forest stands in the study area, and ground plot data. Changes to the original BCLI maps are mainly changes in map unit boundaries. In some cases changes in limiting subclasses were made and, in a few cases, complex map units were segregated into more homogeneous units.

STUDY AREA FOREST RESOURCES

For each sub-area, the area and the proportion of land in each of seven BCLI productivity classes is summarized. The productivity classes indicate productivity according to the average yearly increase in gross volume per unit area, (gross mean annual increment) during a rotation period which is assumed to be one hundred years. No allowance is made for losses from decay, insect attack, fire or other factors. Conversely, no allowance is made for increases in productivity due to intensive forest management. Because of this, the absolute values of the volume increments (m^3/ha/yr) may have little relation to actual timber yields, however, they do provide a semi-quantitative relative scale for comparing potential timber productivity on different lands. The classes are defined as follows:

* Class 2: 6.4 - 7.7 m^3/ha/yr
* Class 3: 5.0 - 6.3 m^3/ha/yr
* Class 4: 3.6 - 4.9 m^3/ha/yr
* Class 5: 2.2 - 3.5 m^3/ha/yr
* Class 6: 0.8 - 2.1 m^3/ha/yr
* Class 7: 0.0 - 0.7 m^3/ha/yr

STUDY AREA PERSPECTIVE

Before proceeding to the detailed inventory descriptions for each of the sub-areas, it is useful to understand the role that the study area's forest resources and activity have in the regional forest sector, as described in the previous chapter.

Forest Resources

Although most of the study area is well suited to timber pro-

duction, very little of the area is under forest cover and even less supports mature stands of commercial trees. Moreover, the area represents an insignificant portion of the region's actual or potential timber supply, with little or no supply arising within the study area at present. Most of the scattered occurrences of mature and immature forest cover found in the study area are on private land, as most of the study area below EL 500 m is alienated from the Crown. Very few of these lands are managed for growing timber. The few areas of mature and immature forest cover that occur on Crown lands in the study area make an insignificant contribution to the allowable cut in the region.

While most of the study area does have moderate forest capability, existing land tenure patterns make any future realization of this capability potential very unlikely.

Forest Use and Activity

Little or no logging is carried out in the study area. The only forest industry activity found in the area during 1980 consisted of the B.C. Timber Ltd. pulpmill and sawmill west of Castlegar and a smaller sawmill at Brilliant. The B.C. Timber Ltd. mill secures its timber supply from outside the study area. The Hadikin Bros. operation at Brilliant also obtained its timber from outside the study area. This mill is reported to be no longer operating.

Currently there are no Crown forest tenures (Timber Sale Licences, Old Temporary Tenures, etc.) within the study area.[1]

[1]Personal communication, B.C. Ministry of Forests, July, 1980.

STUDY AREA FOREST RESOURCES

The following sections provide a more detailed discussion of forest cover and forest capability for each of the ten sub-areas.

SUB-AREA 1:
COLUMBIA RIVER NORTH (HUGH KEENLEYSIDE DAM TO ROBSON)

Forest Cover

Approximately 7% of the sub-area is covered with mature mixed stands of Douglas-fir and western larch with lesser amounts of ponderosa pine and lodgepole pine. Many of the trees in these stands are actually in the 81 to 100 year age class. However, Douglas-fir and ponderosa pine veterans, survivors of past logging and fires, are scattered throughout. Therefore, these stands were classed as mature. The total area of mature stands is 18 hectares.

Immature stands comprise 9% of the sub-area. These include mixed stands of white birch and Douglas-fir with lesser amounts of trembling aspen, lodgepole pine and western larch, approximately 41 to 60 years old, as well as stands of lodgepole pine, western larch and Douglas-fir which are approximately 81 to 100 years old. The total area covered with immature stands is 25 hectares.

The remainder of the sub-area, approximately 233 ha, is in the non-forest category. Most of the non-forest cover is cultivated land; a small amount is non-productive brush.

Forest Capability

Almost all of this sub-area is within BCLI Forest Capability Classes 3 and 4; more specifically, 21% is rated Class 3 and 68% is Class 4. The major limitation to forest productivity in these classes is a lack of adequate soil moisture during the growing season, a result of the prevalent deep, stony, coarse textured soils. Approximately 11% of the sub-area is within Classes 6 and 7. Shallow, coarse textured soils overlying bedrock are the major limitation to productivity in these classes. Exposure is a limitation on sites possessing steep south-facing slopes.

Sub-area Synopsis

Only 43 ha or 16%, of the sub-area supports commercial or potentially commercial forest cover. Most of the sub-area has a moderate capability for timber production but the native forests have been largely destroyed by past logging, fires and settlement. See Table 3.1 for a summary of forest cover types and forest capability classes.

SUB-AREA 2:
COLUMBIA RIVER SOUTH (HUGH KEENLEYSIDE DAM TO CASTLEGAR)

Forest Cover

No mature forest cover is found in this sub-area. Immature stands, approximately 60 to 75 years old, cover 79 hectares or 22% of the area. The two major types are white birch-trembling aspen stands with few coniferous species and lodgepole pine-Douglas-fir stands.

Table 3.1

SUB-AREA 1: COLUMBIA RIVER NORTH

Sub-Area Lands by Present Forest Cover

COVER TYPE	AREA (ha)	% SUB-AREA	% STUDY AREA (4468 ha total)
Mature	18	7	< 1
Immature	25	9	1
Non-forest	233	84	5
TOTAL	276	100	6

Sub-Area Lands by Forest Capability

CAPABILITY CLASS	AREA (ha)	% SUB-AREA	% STUDY AREA (4468 ha total)
2	-	-	-
3	58	21	1
4	188	68	4
5	-	-	-
6	27	10	1
7	3	1	< 1
TOTAL	276	100	6

Western larch is often a minor component of both of these stand types. Western red cedar, western white pine and ponderosa pine are also occasionally found.

The remainder of the area is non-forest and includes industrial sites, rights-of-way and other developed areas.

Forest Capability

BCLI Capability Class 3 lands comprise 46% of the sub-area and Class 4 lands account for 32%. Together these classes occur on 280 ha. The major limitation to productivity is a lack of adequate soil moisture during part of the growing season. Class 5 lands comprise 18% of the sub-area. Productivity of the Class 5 lands is limited mainly by a lack of adequate soil moisture and by shallow soils. Class 7 lands, where productivity is limited mainly by shallow soils over bedrock, make up 4% of the sub-area.

Present Use

The B.C. Timber Ltd. sawmill and pulpmill are located in the sub-area. As noted in Chapter 10 and earlier in this chapter, the wood supply for these mills comes from outside of the study area.

Sub-Area Synopsis

Only 79 ha, or 22%, of the sub-area possesses potentially commercial forest cover. Most of the sub-area is within BCLI forest capability Classes 3 and 4 with Class 3 lands most

Table 3.2

SUB-AREA 2: COLUMBIA RIVER SOUTH

Sub-Area Lands by Present Forest Cover

COVER TYPE	AREA (ha)	% SUB-AREA	% STUDY AREA (4468 ha total)
Mature	-	-	-
Immature	79	22	2
Non-forest	283	78	6
TOTAL	362	100	8

Sub-Area Lands by Forest Capability

CAPABILITY CLASS	AREA (ha)	% SUB-AREA	% STUDY AREA (4468 ha total)
2	-	-	-
3	164	46	4
4	116	32	3
5	66	18	1
6	-	-	-
7	16	4	< 1
TOTAL	362	100	8

extensive, covering 46% of the sub-area. Most of the sub-area is taken up with industrial sites, highway and railway rights-of-way or other non-forest use. See Table 3.2 for a summary of forest cover types and forest capability classes.

SUB-AREA 3: PASS CREEK

Forest Cover

Mature stands dominated by black cottonwood occur on 9 ha of the sub-area. Immature coniferous and mixed (coniferous/deciduous) stands comprise an additional 88 ha. Two major immature stand types occur:

* coniferous stands of lodgepole pine, western larch and western white pine with minor amounts of hemlock and balsam (Abies species), approximately 60 to 75 years old

* mixed stands dominated by trembling aspen and lodgepole pine, approximately 41 to 60 years old.

The remainder of the sub-area is non-forest, principally land which has been cleared for settlement or agricultural use, but also includes some of the area of a large wildfire which occurred in 1967.

Forest Capability

A minor area of BCLI Capability Class 2 land occurs in the northern portion of the sub-area. Class 3 lands comprise 52% of the sub-area and Class 4 lands comprise 40%. Together these

higher capability sites total 622 ha. Classes 5, 6 and 7 lands comprise the remaining 6% of the sub-area.

The Class 2 lands are probably limited in productivity by a lack of some soil nutrients or other soil factors which are difficult to identify without detailed field and laboratory analyses. The productivity of the Class 3, 4 and 5 lands is limited mainly by a lack of adequate soil moisture during the growing season. The Class 5 lands are limited further by shallow soils. Productivity of the Class 6 and 7 lands is limited mainly by shallow soils over bedrock. On sites with steep south-facing slopes in Classes 4, 5 and 6, exposure imposes a further limitation. Some low-lying Class 6 lands are limited by excess soil water or occasional flooding.

Sub-Area Synopsis

Only 97 ha, or 14%, of the sub-area is covered with potentially commercial forest types. Compared to all the other sub-areas, forest capability is high; 94% of the area is Class 4 or better. However, most of the area is non-forest, including lands cleared for settlement and agriculture as well as some severely burned lands. See Table 3.3 for a summary of forest cover types and forest capability classes.

SUB-AREA 4: KOOTENAY RIVER

Forest Cover

There is no commercial or potentially commercial forest cover in the sub-area. Much of the area is covered with improvements such as highways, bridges, dams or residential and industrial

Table 3.3

SUB-AREA 3: PASS CREEK

Sub-Area Lands by Present Forest Cover

COVER TYPE	AREA (ha)	% SUB-AREA	% STUDY AREA (4468 ha total)
Mature	9	1	< 1
Immature	88	13	2
Non-forest	562	85	13
TOTAL	659	100	15

Sub-Area Lands by Forest Capability

CAPABILITY CLASS	AREA (ha)	% SUB-AREA	% STUDY AREA (4468 ha total)
2	14	2	< 1
3	345	52	8
4	263	40	6
5	3	< 1	< 1
6	32	5	1
7	4	1	< 1
TOTAL	659	100	15

developments. Unimproved areas are mainly cultivated or non-productive brush lands.

Forest Capability

BCLI Forest Capability Class 4 lands comprise 71%, or 223 ha, of the sub-area; Class 5 lands comprise 4%; Class 6 lands account for 9%; and Class 7 lands make up the remaining 16% of the sub-area.

Factors limiting productivity in the sub-area are similar but generally more severe than those discussed for Sub-Area 3. Lack of adequate soil moisture during the growing season is a major limitation, particularly for the Class 4 and 5 lands. Shallow soils over bedrock are a major limitation for the Class 5 and 6 lands. Some low-lying Class 7 lands in the Brilliant area and on the north shore of the Columbia River are limited by excessive amounts of soil water or occasional flooding. Exposure is a limiting factor on south-facing slopes of mainly Class 4 lands.

Sub-Area Synops

No commercial or potentially commercial forest types occur in the sub-area. Most of the lands in the sub-area are within BCLI Forest Capability Class 4. The remaining lands are, in order of decreasing extent, within Classes 7, 6 and 5. See Table 3.4 for a summary of forest cover types and forest capability classes.

Table 3.4

SUB-AREA 4: KOOTENAY RIVER

Sub-Area Lands by Present Forest Cover

COVER TYPE	AREA (ha)	% SUB-AREA	% STUDY AREA (4468 ha total)
Mature	-	-	-
Immature	-	-	-
Non-forest	314	100	7
TOTAL	314	100	7

Sub-Area Lands by Forest Capability

CAPABILITY CLASS	AREA (ha)	% SUB-AREA	% STUDY AREA (4468 ha total)
2	-	-	-
3	-	-	-
4	223	71	5
5	14	4	< 1
6	29	9	1
7	48	15	1
TOTAL	314	100	7

SUB-AREA 5: CASTLEGAR-KINNAIRD

Forest Cover

No mature forest cover types occur in the sub-area. Immature stands, approximately 60 to 75 years old comprise 24 ha, or 4%, of the sub-area. Stands are usually dominated by western larch, lodgepole pine and Douglas-fir. Western white pine, western hemlock, western red cedar and white birch also occur and are occasionally locally abundant.

The remainder of the sub-area is non-forest. Much of the area is taken up by improvements, such as highways, roads, railroad rights-of-way and transmission lines, and by industrial and residential development including the settlements at Castlegar and Kinnaird.

Forest Capability

The entire sub-area is within BCLI Forest Capability Classes 3 and 4, which are approximately equal in extent. The major limitation restricting productivity is a lack of adequate soil moisture during the growing season.

Sub-Area Synopsis

Potentially commercial forest cover occurs over only 24 ha of the sub-area. Forest capability is moderate and relatively good for the study area. Because of generally good operability and close proximity to mills, opportunities for intensive forest management exist in this sub-area. However, competition with other land uses (industrial, residential and agricultural)

and existing land ownership patterns would make realization of intensive forestry opportunities difficult. Table 3.5 presents a summary of forest cover types and forest capability classes.

SUB-AREA 6: CASTLEGAR AIRPORT

Forest Cover

Mature forest cover dominated by western larch, Douglas-fir and white birch comprises 9%, or 50 ha, of this sub-area. No areas of immature forest cover occur. Non-forest types comprise the remainder of the sub-area. The non-forest area includes cultivated areas, non-productive brush lands, settlements and developments such as the Castlegar Airport and the Castlegar Golf Course.

Forest Capability

The entire sub-area is within BCLI Forest Capability Classes 3 and 4. Class 3 lands comprise 39% and Class 4 lands occur over 61% of the sub-area. The major limitation to forest productivity is the lack of adequate soil moisture during the growing season.

Sub-Area Synopsis

Mature forest cover occurs over 50 ha of the sub-area. Non-forest types are dominant comprising 91% of the sub-area. Forest capability is moderate and generally comparable to that of Sub-Area 5. See Table 3.6 for a summary of forest cover types and forest capability classes in this sub-area.

Table 3.5

SUB-AREA 5: CASTLEGAR - KINNAIRD

Sub-Area Lands by Present Forest Cover

COVER TYPE	AREA (ha)	% SUB-AREA	% STUDY AREA (4468 ha total)
Mature	-	-	-
Immature	24	4	< 1
Non-forest	522	96	12
TOTAL	546	100	12

Sub-Area Lands by Forest Capability

CAPABILITY CLASS	AREA (ha)	% SUB-AREA	% STUDY AREA (4468 ha total)
2	-	-	-
3	272	50	6
4	274	50	6
5	-	-	-
6	-	-	-
7	-	-	-
TOTAL	546	100	12

Table 3.6

SUB-AREA 6: CASTLEGAR AIRPORT

Sub-Area Lands by Present Forest Cover

COVER TYPE	AREA (ha)	% SUB-AREA	% STUDY AREA (4468 ha total)
Mature	50	9	1
Immature	-	-	-
Non-forest	497	91	11
TOTAL	547	100	12

Sub-Area Lands by Forest Capability

CAPABILITY CLASS	AREA (ha)	% SUB-AREA	% STUDY AREA (4468 ha total)
2	-	-	-
3	215	39	5
4	332	61	7
5	-	-	-
6	-	-	-
7	-	-	-
TOTAL	547	100	12

As in Sub-Area 5, generally good operability, or ease of logging, and close proximity to mills could create good opportunities for intensive forest management over much of Sub-Area 6. However, competition from other land uses and existing land ownership patterns would make realization of these opportunities difficult.

SUB-AREA 7: CHAMPION AND JORDAN CREEKS

Forest Cover

No mature forest types occur in this sub-area. However, immature types comprise 45%, or 107 ha, of the sub-area. These stands are of mixed coniferous/deciduous composition and are approximately 41 to 60 years old. White birch, trembling aspen, lodgepole pine, western larch and Douglas-fir are the major tree species. Western white pine and ponderosa pine also occur.

The remainder of the sub-area is non-forest including areas of open range and non-productive brush as well as cultivated lands.

Forest Capability

BCLI Forest Capability Class 3 and 4 lands occur over virtually all of this sub-area. Classes 6 and 7 sites together total only 1% of the sub-area.

A lack of adequate soil moisture during the growing season is the major factor limiting productivity on lands in Classes 3 and 4. The major limitation on Class 6 and 7 lands is shallow

soils over bedrock. Exposure may also be a limitation on some steep Class 6 lands with southerly aspects.

Sub-Area Synopsis

With 107 ha, or 45%, of the sub-area containing immature forest types, this sub-area is by far the most forested sub-area in the study area. Most of these stands occur at elevations of approximately 430 metres a.s.l. or greater. The bulk of the land area at lower elevations immediately along the Columbia River is non-forest.

BCLI Forest Capability Class 3 and 4 sites account for almost all of the sub-area. Class 3 lands are predominant. In general, forest capability is moderate and compares favourably with that in other sub-areas. See Table 3.7 for a summary of forest cover types and forest capability types.

Intensive forest management might be an attractive possibility on the flatter Class 3 and 4 lands. As in Sub-Areas 5 and 6, relatively high land costs and the existing land ownership patterns diminish the practicability of implementing intensive management programs.

SUB-AREA 8: BLUEBERRY CREEK - GENELLE

Forest Cover

The entire sub-area is in non-forest cover. Much of the sub-area is occupied by roads and highways, power, gas and railroad rights-of-way and the settlements of Blueberry Creek and Genelle. Areas of non-commercial deciduous stands and non-

Table 3.7

SUB-AREA 7: CHAMPION AND JORDAN CREEKS

Sub-Area Lands by Present Forest Cover

COVER TYPE	AREA (ha)	% SUB-AREA	% STUDY AREA (4468 ha total)
Mature	-	-	-
Immature	107	45	2
Non-forest	131	55	3
TOTAL	238	100	5

Sub-Area Lands by Forest Capability

CAPABILITY CLASS	AREA (ha)	% SUB-AREA	% STUDY AREA (4468 ha total)
2	-	-	-
3	169	71	4
4	66	28	1
5	-	-	-
6	2	1	< 1
7	1	< 1	< 1
TOTAL	238	100	5

commercial, sparsely stocked coniferous stands of ponderosa pine, Douglas-fir and western white pine do occur in places.

Forest Capability

All lands in the sub-area are rated within BCLI Forest Capability Classes 3 and 4. However, 95% of the sub-area is composed of Class 4 lands and only 5% is in Class 3. The major factor limiting productivity in the sub-area is a lack of adequate soil moisture during the growing season.

Sub-Area Synopsis

No commercial or potentially commercial forest types occur in the sub-area. Forest capability is moderate but generally lower than in many other sub-areas.

Table 3.8 presents a summary of present forest cover and forest capability in this sub-area.

SUB-AREA 9: BILLY CREEK

Forest Cover

No mature forest cover types occur in the sub-area. Immature stands, approximately 60-75 years old, comprise 22 ha, or 5%, of the sub-area. The major tree species in these stands are lodgepole pine, western larch and Douglas-fir. Non-forest cover, principally non-productive brush with scattered trees, is dominant in the remaining areas.

Table 3.8

SUB-AREA 8: BLUEBERRY CREEK - GENELLE

Sub-Area Lands by Present Forest Cover

COVER TYPE	AREA (ha)	% SUB-AREA	% STUDY AREA (4468 ha total)
Mature	-	-	-
Immature	-	-	-
Non-forest	595	100	13
TOTAL	595	100	13

Sub-Area Lands by Forest Capability

CAPABILITY CLASS	AREA (ha)	% SUB-AREA	% STUDY AREA (4468 ha total)
2	-	-	-
3	29	5	< 1
4	566	95	13
5	-	-	-
6	-	-	-
7	-	-	-
TOTAL	595	100	13

Forest Capability

BCLI Forest Capability Class 3 and 4 lands comprise about three-quarters of the sub-area. Class 5, 6 and 7 sites account for 11%, 3% and 10% of the sub-area respectively.

The major factor limiting productivity on Class 3, 4 and 5 lands is a lack of adequate soil moisture during the growing season. Productivity of Class 5 lands is also limited by adverse exposure. Shallow soils over bedrock are a major limitation for Class 6 and 7 lands. Productivity on some Class 7 lands is also limited by active erosion or excessively stony or rocky soils.

Sub-Area Synopsis

Only 22 ha, representing 5% of the sub-area, contains potentially commercial forest cover. Forest capability is generally moderate, although one-quarter of the sub-area is in Capability Classes 5, 6 and 7. Overall forest capability for the sub-area is lower than in other sub-areas. Table 3.9 summarizes the areas in different forest cover types and forest capability classes for the sub-area.

SUB-AREA 10: OASIS (Including the Murphy Creek Till Site)

Forest Cover

The entire sub-area is composed of non-forest cover including areas of non-commercial deciduous cover, non-productive brush and cultivated lands. Some conifers, notably western larch and

Table 3.9

SUB-AREA 9: BILLY CREEK

Sub-Area Lands by Present Forest Cover

COVER TYPE	AREA (ha)	% SUB-AREA	% STUDY AREA (4468 ha total)
Mature	-	-	-
Immature	22	5	< 1
Non-forest	384	95	9
TOTAL	406	100	9

Sub-Area Lands by Forest Capability

CAPABILITY CLASS	AREA (ha)	% SUB-AREA	% STUDY AREA (4468 ha total)
2	-	-	-
3	96	24	2
4	212	52	5
5	45	11	1
6	11	3	< 1
7	42	10	1
TOTAL	406	100	9

pines occur scattered throughout the sub-area but they do not constitute potentially commercial stands of timber.

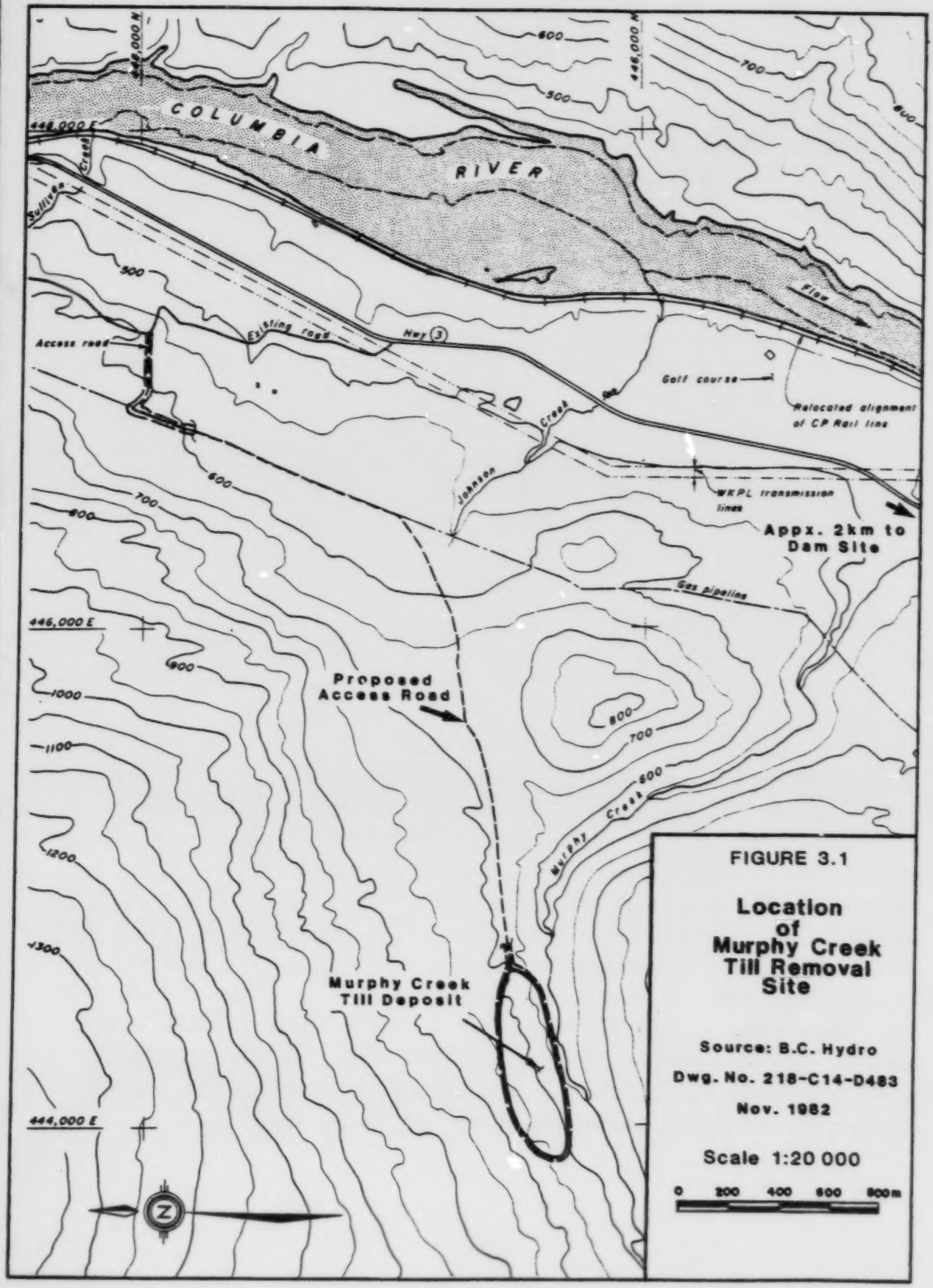
Forest Capability

BCLI Forest Capability Class 3 and 4 lands comprise most of the sub-area with Class 3 sites occurring on 45% of the area and Class 4 lands accounting for an additional 43%. Class 5 and 6 lands comprise the remainder of the sub-area.

The major factor limiting productivity on Class 3, 4, 5 and 6 lands is a lack of adequate soil moisture during the growing season. The Class 5 and 6 lands are also limited by shallow soils over bedrock. In some sites, Class 6 lands are also limited by adverse exposure.

Murphy Creek Till Site

Three potential sources of till material for use in the construction of the Murphy Creek dam were selected by B.C. Hydro near the end of the environmental field studies. The Murphy Creek, Sullivan Creek and Hanna Creek till sites, located on the west side of the Columbia River, were identified as possible till sites. The Sullivan Creek and Hanna Creek sites were not investigated in any detail as these two locations were found to contain unsuitable materials. The discussion that follows is therefore limited to a general description of the forest resources of the Murphy Creek till site (Figure 3.1). An overview assessment of developing the 17 ha pit and 12 ha access road is presented in the following chapter.


COLUMBIA
RIVER
Flow
Existing road
Hwy 3
Access road
Golf course
Relocated alignment of CP Rail line
Johnson Creek
WKPL transmission lines
Appx. 2km to Dam Site
Gas pipeline
Proposed Access Road
Murphy Creek
Murphy Creek Till Deposit
446,000 E
444,000 E
446,000 N
448,000 E
600
700
800
900
1000
1100
1200
1300
FIGURE 3.1
Location of Murphy Creek Till Removal Site
Source: B.C. Hydro
Dwg. No. 218-C14-D483
Nov. 1982
Scale 1:20 000
0 200 400 600 800m

STUDY AREA FOREST RESOURCES

The forest resource description and impact assessment are based upon examination of available published data. No field work was performed by Talisman personnel. However, information in the form of aerial photographs, field notes from other study team members (Beak Consultants), forest cover maps and BCLI forest capability maps was examined to identify general vegetation features and assess the impact of site development. Details regarding land ownership and tenure were not determined.

An immature mixed coniferous-deciduous forest characterizes the till site. The B.C. Ministry of Forests classifies the area as a medium quality forest site, as volumes per hectare are generally moderate to low.

Field studies conducted by Beak Consultants near the site revealed that:

> The vegetation in this area showed a strong response to aspect. The south aspects were dominated by a broad leaf forest. Birch was the most abundant tree species; however, others of importance were black cottonwood, mountain alder, western larch, and trembling aspen. The understory species included Saskatoon, willow, hazelnut, waxberry, mahonia and false box. The ground flora was predominantly grass, bearberry and moss with few other species. Trembling aspen gained importance with an increase in elevation until, at a level of approximately 2,800 feet, the clones of aspen dominated the area. The inter-clonal areas were occupied by Saskatoon, Rocky Mountain juniper and waxberry. Hazelnut and mahonia were also common but scattered in their distribution. The understory was comprised of abundant grasses, mosses and bearberry.

STUDY AREA FOREST RESOURCES

The north and northeast aspects along Murphy Creek were almost exclusively dense western larch with very few other species interspersed. The understory was also restricted; false box was the only abundant species although Saskatoon, willow and hazelnut occupied sporadically. The groundcover was restricted to primarily moss, grass and bearberry.

The riparian vegetation of the Murphy Creek till site was characterized by a closed mixed forest. White birch was the most abundant tree species, followed by black cottonwood and western larch. Alder was ubiquitous in a single band along either riverbank. Tree species which occurred sporadically in the area were Douglas maple, western hemlock, Douglas-fir, red cedar, white pine and grand fir.

The understory was relatively dense. Thimbleberry, snowberry, and false box were the most abundant shrubs. Others occurring in a scattered distribution were red osier dogwood, hazelnut, blue elderberry, mahonia, mock orange, red-stem ceanothus and black blueberry.

The ground cover in these riparian areas was sparse. Commonly occurring species (though never abundant) were twinflower, prince's pine, marsh violet, bearberry, starflowered solomon's seal, bracken fern and horsetail.[1]

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[1]Notes on Field Survey, Beak Consultants Ltd.

STUDY AREA FOREST RESOURCES

Sub-Area Synopsis

No commercial or potentially commercial forest cover types occur in the sub-area. Forest capability is moderate; nearly equal areas of Capability Classes 3 and 4 occur over most of the sub-area. Table 3.10 summarizes the areas in different forest cover types and forest capability classes within the sub-area.

STUDY AREA SUMMARY

From the detailed sub-area forest inventory descriptions presented above, several features of the study area are apparent. Most of the study area's lands, estimated to total about 4,468 ha, consist of sites with moderate forest capability. About 90% of the area falls within BCLI Forest Capability Classes 3 and 4. The inventory revealed no Class 1 sites and only 14 ha were classified within Class 2.

Although 90% of the land in the study area is well suited to timber production, less than 10% of the area presently supports even marginally commercial forest cover. A total of only 423 ha is considered potentially commercial and of this only 77 ha is mature timber with any immediate exploitation potential. Although some potential does exist in a few areas for intensive forest management, little or no timber management is apparent in any part of the study area.

Table 3.11 provides a summary of the forest capability and present forest cover of study area lands. As with the previous disciplines' inventory data, these estimates are subject to the errors that map transfer, scale transposition and digitizing procedures normally incur.

Table 3.10

SUB-AREA 10: OASIS[a]

Sub-Area Lands by Present Forest Cover

COVER TYPE	AREA (ha)	% SUB-AREA	% STUDY AREA (4468 ha total)
Mature	-	-	-
Immature	-	-	-
Non-forest	524	100	12
TOTAL	524	100	12

Sub-Area Lands by Forest Capability

CAPABILITY CLASS	AREA (ha)	% SUB-AREA	% STUDY AREA (4468 ha total)
2	-	-	-
3	238	45	5
4	227	43	5
5	5	1	< 1
6	54	10	1
7	-	-	-
TOTAL	524	100	12

[a]Estimates do not include 29 ha pit and access road area which will be affected by development of the Murphy Creek till site.

Table 3.11

SUMMARY OF STUDY AREA FOREST RESOURCES

Study Area Lands by Present Forest Cover

COVER TYPE	AREA (ha)	% STUDY AREA (4468 ha total)
Mature	77	2
Immature	346	8
Non-forest	4045	91
TOTAL	4468	100

Study Area Lands by Forest Capability

CAPABILITY CLASS	AREA (ha)	% STUDY AREA (4468 ha total)
2	14	< 1
3	1586	35
4	2468	55
5	132	3
6	153	3
7	115	3
TOTAL	4468	100

STUDY AREA FOREST RESOURCES

The only forestry activity found in the study area during the initial forestry studies consisted of the B.C. Timber Ltd. pulpmill and sawmill near Castlegar, and the Hadikin Brothers' sawmill at Brilliant, both of which were drawing their timber from outside the study area. The B.C. Timber operation is currently the only active forestry company in the area since the closing of the Hadikin mill. Table 2.2, contained in the previous chapter, summarizes annual activity at this mill.

CHAPTER 4

FORESTRY IMPACT EVALUATION

PROJECT DEFINITION

In the following sections, the potential direct impact of flooding to three alternate reservoir levels is summarized and discussed in relation to the local and regional forest industry. The three reservoir levels considered include the proposed level of EL 424 m, as well as two alternate, higher reservoir levels:

* EL 424 metres a.s.l. (proposed)
* EL 427 metres a.s.l.
* EL 430 metres a.s.l.

The potential impact of construction of the proposed dam, powerhouse and associated works is also included. The preliminary damsite works considered are those described in the draft document Murphy Creek Project Engineering Description prepared by B.C. Hydro in November, 1982 (B.C. Hydro, 1982a). Conceptual layouts of required highway and railway rights-of-way relocation associated with damsite construction were assessed as part of the damsite considerations, based on a B.C. Hydro drawing of November, 1982 (B.C. Hydro, 1982b). The proposed

relocation of the CPR rail line in the Birchbank area necessitated by the project was assessed as outlined in Murphy Creek Hydroelectric Development Impact on Existing CP Rail Facilities (Thurber, 1982). Proposed construction areas, including spoil areas associated with dam construction, were assessed based on a B.C. Hydro drawing of November, 1982 (B.C. Hydro 1982c). All of these plans are preliminary and conceptual in nature and, as such, are subject to revision. The potential forestry impacts of proposed till excavation at a site near Murphy Creek have been assessed.

Preliminary B.C. Hydro proposals for bank protection, berming, and filling of depressonal areas (B.C. Hydro, 1982d,e,f) were also examined. While these works, as well as the lack of shoreline protection for most of the study area, may result in minor effects on areas with forest cover or capability, these effects have been judged to be insignificant to the overall assessment of forestry impacts, and no attempt has been made to measure them.

The focus of the assessment carried out in this chapter is on possible impacts affecting the local and regional forest industry. It should be noted that such analyses may not seem meaningful to owners of private lands with small woodlots or scattered timber values. Timber may have special individual value to different landowners. Assessment of the value varies not only with the characteristics of different parcels of land but also with the different perceptions of individual landowners. Assessment of these values is beyond the scope of the forestry studies as stated in the study's terms of reference.

FORESTRY IMPACT EVALUATION

METHODOLOGY AND LIMITATIONS

Areas of mature and immature timber and of lands of different forest capability (according to BCLI class) which would be flooded at the three reservoir levels considered are summarized for each sub-area and for the entire study area in the following sections. The areas flooded at a given reservoir level were determined by planimeter on 1:10,000 orthophoto mapping of the study area prepared by B.C. Hydro. Estimates were later checked against 1:2500 and 1:1250 scale maps and obvious errors corrected. Forest cover information was interpreted from updated forest cover maps (see Chapter 3). Forest capability types were mapped directly on the orthophoto prints.

From a theoretical standpoint, the potential impact of the proposed project on timber resources is directly related to two distinct characteristics: the potential loss of the value of standing merchantable timber (stumpage) and the potential loss of productive forest land base. As discussed in Chapter 3, the amount and proportion of standing merchantable timber in the study area is small. About 423 hectares, comprising approximately 9% of the study area, are covered with mature or immature forest cover. Less than 2% of the study area supports mature stands of timber. Stands within any of the proposed reservoir areas were judged to present a poor or marginal logging chance because of their low total volume, often low volume per hectare, usually low to medium timber quality, and the scattered occurrence of stands in small patches or narrow strips.

An assessment based on standing timber values might therefore considerably underestimate impacts on the timber resource in the study area and region. For this reason, consideration was also given to loss of forest capability in discussing impacts.

FORESTRY IMPACT EVALUATION

Reliance on forest capability as a basis of impact assessment, however, has some significant limitations, especially considering the present and projected land use patterns in the study area. Forest capability ratings do not indicate whether timber will, in fact, be produced on any given area. Ultimately, this is determined by complex historical, social and economic factors. Impact assessment based on land capability alone can result in inflated estimates of land values when a land area's multiple capabilities are all assessed in isolation with no attempt to account for the actual future uses most likely to occur in the absence of the impact.

In addition to this fundamental shortcoming, reliance on forest capability information as a basis of impact assessment also encounters a number of more technical limitations:

* technical limitations of sampling and mapping

* technical assumptions adopted for estimating yield

* lack of operational or economic criteria in forest capability classification.

The first set of limitations has been widely discussed in existing literature. Such discussion is beyond the scope of this report. However, it can be noted that BCLI forest capability methodology is a systematic but crude method for estimating productivity. However, in many cases, it is the best or only method readily available. Furthermore, all existing methods of estimating and mapping forest capability suffer from weaknesses associated with mapping and sampling.

The second limitation has been mentioned in Chapter 3. Timber yield in cubic metres per hectare per year (mean annual in-

crement) is estimated for fully stocked, natural stands composed of indicator species, that is, species which were found and judged to be well suited to the growing site. Mean annual increments (MAI's) are calculated with no allowance for losses from fire, insects, decay or waste, and no allowance for increases from intensive silvicultural practices. Therefore, in the absence of intensive silviculture, the estimated MAI's will probably be unrealistically high. If intensive silviculture is practiced, however, it cannot be predicted whether or not estimates will be high, low or reasonably accurate. Varying levels of utilization, particularly over long time periods, are also difficult to predict. Therefore, the absolute values of estimated MAI's should be viewed with some skepticism. If technical limitations are kept in mind, the different capability classes (based on estimated MAI's) can be used to compare the potential productivity of different map units.

Finally, BCLI forest capability gives only an indication of the inherent ability of land to produce timber. It does not indicate if site operability will allow economic harvesting. Areas of moderate to good capability may occur on steep slopes or in isolated areas which are difficult and expensive to harvest and manage. Timber quality (e.g., tree size, straightness, number of limbs or amount of defect) is not considered.

Errors of Measurement

It should also be recognized that the method used for actually measuring areas of forest cover or capability which could be lost to the proposed dam and reservoir has several limitations which probably has resulted in some degree of error. These limitations include:

* error due to the difficulty in accurately measuring the area of small or narrow polygons, and those steep areas such as river banks where the three reservoir levels occur close together on a horizontal plane.

* error due to the type lines of some polygons obscuring the topographic information on the base map.

* error due to a lack of detailed topographic information for about 1.6 km of sub-areas 9 and 10, immediately upstream of the proposed damsite area. Potential inundation in these areas was not estimated.

However, even with these minor problems, the following impact assessment is considered to reflect, within reasonable limits of accuracy, the potential losses of forest cover and areas of forest capability due to the construction of the proposed Murphy Creek dam and the clearing of the reservoir area. Digitizing error is estimated to be within ± 5%. The amount of error in topographic mapping is typically ± 1/2 contour interval.

The following sections discuss the potential impacts of the project both in terms of standing timber lost and loss of long term capability for each of the ten sub-areas.

SUB-AREA 1:
COLUMBIA RIVER NORTH (HUGH KEENLEYSIDE DAM TO ROBSON)

Forest Cover and Timber Volumes Inundated

In sub-area 1, the total possible forest area inundated at any of the reservoir levels considered is less than one hectare and

consists of a few patches of Douglas-fir, western larch with lodgepole and ponderosa pine stands, and some white birch-trembling aspen stands. The maximum estimated volume inundated would be only approximately 40 cubic metres. Because of their low volume per hectare and scattered occurrence these stands are considered non-commercial and therefore no stumpage estimate has been made. Because of this, the impact of inundation at any reservoir level on standing timber values is considered negligible in this sub-area.

Forest Capability Types Inundated

Table 4.1 shows the total land area inundated in sub-area 1 by BCLI forest capability class for the proposed reservoir level of EL 424 m as well as the two alternate reservoir levels considered. At EL 424 m 4.9 ha is involved. All the land is either Class 3 or 4. At the higher reservoir levels considered the total land area inundated increases almost linearly although the proportion of Class 3 land decreases.

While these land areas have a moderate potential for producing timber, there are no commercial or potentially commercial timber stands present and it seems doubtful that the lands will be managed for timber production. Therefore the possible impact of the project on the timber resource potential of this sub-area is considered negligible.

Table 4.1

SUB-AREA 1: COLUMBIA RIVER NORTH

Areas of Forest Capability Types Inundated
at Three Possible Reservoir Levels
(in Hectares)

BCLI FOREST CAPABILITY CLASS	River to 424 m a.s.l.	424-427 m a.s.l.	CUMULATIVE TOTAL	427-430 m a.s.l.	TOTAL
1	-	-	-	-	-
2	-	-	-	-	-
3	1.5	1.6	3.1	2.1	5.2
4	3.4	5.5	8.9	12.7	21.6
5	-	-	-	-	-
6	-	-	-	-	-
7	-	-	-	-	-
TOTAL	4.9	7.1	12.0	14.8	26.8

SUB-AREA 2:
COLUMBIA RIVER SOUTH (HUGH KEENLEYSIDE DAM TO CASTLEGAR)

Forest Cover and Timber Volumes Inundated

A maximum area of less than one-tenth of a hectare of forest cover is involved in the possible inundation of this sub-area. The stands are dominated by white birch and trembling aspen. Because of the small volume and the dominantly deciduous species in these stands they are considered to have no stumpage value. While the total area and volume that would be inundated obviously increase at the higher reservoir levels, there is no other appreciable difference between any three of the proposed levels. The impact of inundation on standing timber values in this sub-area at any of the three reservoir levels considered is considered negligible.

Forest Capability Types Inundated

The total land area inundated by forest capability class at each reservoir level under consideration is shown in Table 4.2. All lands are Class 3 and 4 and more Class 3 lands are present at all three reservoir levels. A maximum of 18.9 ha is involved. Since there are no commercial or potentially commercial timber stands present and it seems doubtful that these lands would be managed for timber production in the absence of the project, the impact of any reservoir level on the future resource potential of this sub-area is considered negligible.

Table 4.2

SUB-AREA 2: COLUMBIA RIVER SOUTH

Areas of Forest Capability Types Inundated
at Three Possible Reservoir Levels
(in Hectares)

BCLI FOREST CAPABILITY CLASS	River to 424 m a.s.l.	424-427 m a.s.l.	CUMULATIVE TOTAL	427-430 m a.s.l.	TOTAL
1	-	-	-	-	-
2	-	-	-	-	-
3	-	5.4	5.4	7.6	13.0
4	0.9	3.0	3.9	2.0	5.9
5	-	-	-	-	-
6	-	-	-	-	-
7	-	-	-	-	-
TOTAL	0.9	8.4	9.3	9.6	18.9

SUB-AREA 3: PASS CREEK

Forest Cover and Timber Volumes Inundated

For the Pass Creek sub-area, the proposed reservoir level of EL 424 m would inundate 1 hectare of a cottonwood stand with a volume of 200 cubic metres. Reservoir levels greater than 424 m have no additional impact on standing timber.

Forest Capability Types Inundated

The total area that would be inundated in the Pass Creek sub-area at each considered reservoir level by forest capability class is shown in Table 4.3. While a total of 76 ha of Class 3 and 4 land would be inundated at the proposed reservoir elevation of 424 m, only 1 ha of this area is covered with potentially commercial forest and it seems unlikely that any of the area will be managed for timber production in the future.

Therefore the only possible impact of any consequence on the timber resource is considered to be the loss of the 1 hectare stand of cottonwood.

SUB-AREA 4: KOOTENAY RIVER

Forest Cover and Timber Volumes Inundated

No forest cover or timber volumes will be inundated in sub-area 4 at any of the three reservoir levels considered.

Table 4.3

SUB-AREA 3: PASS CREEK

Areas of Forest Capability Types Inundated
at Three Possible Reservoir Levels
(Hectares)

BCLI FOREST CAPABILITY CLASS	River to 424 m a.s.l.	424-427 m a.s.l.	CUMULATIVE TOTAL	427-430 m a.s.l.	TOTAL
1	-	-	-	-	-
2	-	-	-	-	-
3	3.0	47.0	50.0	49.0	99.0
4	73.0	1.0	74.0	1.5	75.5
5	-	-	-	-	-
6	29.7	-	29.7	-	29.7
7	-	-	-	-	-
TOTAL	105.7	48.0	153.7	50.5	204.2

Forest Capability Types Inundated

Table 4.4 summarizes the total land areas that would be inundated in sub-area 4 at the three reservoir levels considered, by BCLI forest capability class. The proposed EL 424 m reservoir level affects only one half hectare of Class 4 land; the rest of the 47.5 hectares potentially inundated at this level is Class 7 land, considered unsuitable for the production of commercial timber. Inundation of the higher capability sites would occur at the higher possible reservoir levels, including a maximum of 67 ha of land, mostly rated Class 4, at the highest reservoir level considered.

Since there are no standing timber values involved and lands are not expected to be managed for timber production in this sub-area, no project impacts on the future timber potential of this sub-area are expected.

SUB-AREA 5: CASTLEGAR-KINNAIRD

Forest Cover and Timber Volumes Inundated

The proposed reservoir level of EL 424 m would not affect any standing timber volumes in sub-area 5. The EL 427 m and EL 430 m levels would result in inundation of approximately equal areas and volumes of some western larch, white birch, lodgepole pine and Douglas-fir stands. However, these small areas (2.5 and 3 ha) have such low timber volumes per hectare that the stands are considered non-commercial and no stumpage value has been estimated. In this sub-area the impact of inundation on standing timber values at any of the reservoir levels is considered negligible.

Table 4.4

SUB-AREA 4: KOOTENAY RIVER

Areas of Forest Capability Types Inundated
at Three Possible Reservoir Levels
(Hectares)

BCLI FOREST CAPABILITY CLASS	River to 424 m a.s.l.	424-427 m a.s.l.	CUMULATIVE TOTAL	427-430 m a.s.l.	TOTAL
1	-	-	-	-	-
2	-	-	-	-	-
3	-	-	-	-	-
4	0.5	51.0	51.5	13.0	64.5
5	-	-	-	1.0	1.0
6	-	-	-	1.5	1.5
7	47.0	1.5	48.5	-	48.5
TOTAL	47.5	52.5	100.0	15.5	115.5

Forest Capability Types Inundated

Areas inundated in sub-area 5, by forest capability class, at the three reservoir levels are summarized in Table 4.5. No capable areas are potentially affected at the proposed 424 m elevation. At elevation 427 m, 2.5 ha of Class 3 and 4 sites would be inundated, and a further 3 ha of Class 3 and 4 lands would be affected at EL 430 m. However, none of these areas are projected to be used for forestry in the future in the absence of the project and therefore impact on the future timber potential of this sub-area is considered to be nil.

SUB-AREA 6: CASTLEGAR AIRPORT

Forest Cover and Timber Volumes Inundated

No standing timber will be affected in sub-area 6 by any of the three reservoir levels examined.

Forest Capability Types Inundated

All lands which would be inundated in sub-area 6 by any of the three reservoir levels are rated Class 4 (see Table 4.6). About 19 ha would be inundated at the proposed level of EL 424 m. Increasing the reservoir level from EL 424 to EL 427 m results in an increment of only 9 ha inundated whereas increasing to the 430 m elevation would result in a further 22.5 ha inundated. However, since no commercial or potentially commercial stands are present and since it is very unlikely that the area will ever be managed for timber production, the potential impact of any of the three reservoir levels on the forest resource potential is considered to be negligible.

Table 4.5

SUB-AREA 5: CASTLEGAR - KINNAIRD

Areas of Forest Capability Types Inundated
at Three Possible Reservoir Levels
(Hectares)

BCLI FOREST CAPABILITY CLASS	River to 424 m a.s.l.	424-427 m a.s.l.	CUMULATIVE TOTAL	427-430 m a.s.l.	TOTAL
1	-	-	-	-	-
2	-	-	-	-	-
3	-	2.0	2.0	2.0	4.0
4	-	0.5	0.5	1.0	1.5
5	-	-	-	-	-
6	-	-	-	-	-
7	-	-	-	-	-
TOTAL	0.0	2.5	2.5	3.0	5.5

Table 4.6

SUB-AREA 6: CASTLEGAR AIRPORT

Areas of Forest Capability Types Inundated
at Three Possible Reservoir Levels
(Hectares)

BCLI FOREST CAPABILITY CLASS	River to 424 m a.s.l.	424-427 m a.s.l.	CUMULATIVE TOTAL	427-430 m a.s.l.	TOTAL
1	-	-	-	-	-
2	-	-	-	-	-
3	-	-	-	-	-
4	19.0	9.0	28.0	22.5	50.5
5	-	-	-	-	-
6	-	-	-	-	-
7	-	-	-	-	-
TOTAL	19.0	9.0	28.0	22.5	50.5

SUB-AREA 7: CHAMPION AND JORDAN CREEKS

Forest Cover and Timber Volumes Inundated

In this sub-area, some forest cover would be inundated at all three reservoir levels considered. A maximum of 4.4 ha of cover is involved at the proposed reservoir level of EL 424 m. The stands affected are mixed stands dominated by white birch, trembling aspen, lodgepole pine, western larch and Douglas-fir. Cottonwood is also present at the mouth of Champion Creek. However, because of low volumes per acre, poor timber quality and small extent, none of these stands is considered to be commercial and no stumpage values have been attributed to them. The potential impact on the standing timber resource of the three reservoir levels examined is therefore considered to be negligible.

Forest Capability Types Inundated

All lands which would be inundated in sub-area 7 are in BCLI Forest Capability Class 3 or 4 (see Table 4.7). At the proposed reservoir level of EL 424 m, these lands total 2.0 ha. A maximum of 24.5 ha would be inundated at the highest reservoir level considered. While these lands have a moderate potential for timber production, they are not adequately stocked with suitable species and are not being managed for timber production. It is not anticipated that they would be managed in the future in the absence of the project. Project impacts on the forest resource potential would therefore be unlikely.

Table 4.7

SUB-AREA 7: CHAMPION AND JORDAN CREEKS

Areas of Forest Capability Types Inundated
at Three Possible Reservoir Levels
(Hectares)

BCLI FOREST CAPABILITY CLASS	River to 424 m a.s.l.	424-427 m a.s.l.	CUMULATIVE TOTAL	427-430 m a.s.l.	TOTAL
1	-	-	-	-	-
2	-	-	-	-	-
3	1.5	7.5	9.0	6.0	15.0
4	0.5	5.0	5.5	4.0	9.5
5	-	-	-	-	-
6	-	-	-	-	-
7	-	-	-	-	-
TOTAL	2.0	12.5	14.5	10.0	24.5

SUB-AREA 8: BLUEBERRY CREEK - GENELLE

Forest Cover and Timber Volumes Inundated

In sub-area 8, no forest cover or timber volumes will be inundated at any of the three reservoir levels considered.

Forest Capability Types Inundated

All lands potentially inundated in sub-area 8 are in BCLI Forest Capability Class 4 (see Table 4.8). At the proposed reservoir elevation of 424 m, 28.4 ha would be inundated. Since there are no timber values affected at any of the three reservoir levels in this sub-area and it is very unlikely that lands inundated would ever be managed for timber production, no impacts on future timber resources are envisioned for this sub-area.

SUB-AREA 9: BILLY CREEK

Forest Cover and Timber Volumes Inundated

In this sub-area, 7.2 ha of forest cover with a volume of 40 cubic metres will be affected at the proposed reservoir level. At the highest reservoir level considered, this would increase to 8 ha and 45 cubic metres. Stands within the proposed reservoir basin are composed of mixtures of white birch, lodgepole pine, trembling aspen and western larch with low volumes per hectare. The stands have been classified as environmentally sensitive areas by the most recent B.C. Ministry of Forests inventory mapping because of steep slopes and unfavourable soil conditions. Since volumes are low, and operability and regen-

Table 4.8

SUB-AREA 8: BLUEBERRY CREEK - GENELLE

Areas of Forest Capability Types Inundated
at Three Possible Reservoir Levels
(Hectares)

BCLI FOREST CAPABILITY CLASS	River to 424 m a.s.l.	424-427 m a.s.l.	CUMULATIVE TOTAL	427-430 m a.s.l.	TOTAL
1	-	-	-	-	-
2	-	-	-	-	-
3	-	-	-	-	-
4	28.4	6.6	35.0	18.2	53.2
5	-	-	-	-	-
6	-	-	-	-	-
7	-	-	-	-	-
TOTAL	28.4	6.6	35.0	18.2	53.2

eration would be difficult, these stands are considered to be non-commercial. Therefore, the impact on the standing timber resource of inundation at any of the proposed reservoir levels is considered to be negligible.

Forest Capability Types Inundated

In the Billy Creek sub-area, the lands which would be inundated at the three proposed reservoir levels are predominantly in BCLI Forest Capability Classes 3 and 4 (see Table 4.9). At the proposed reservoir level of EL 424 m, a total of 18 ha of Classes 3, 4, and 5 would be affected.

Damsite and Associated Construction Areas

Development of an aggregate borrow area, as well as the damsite area, including work areas, would impact approximately 40 ha of Class 4, 5, and 7 forest land; about 25 ha of Class 4, 10 ha of Class 5 and 5 ha of Class 7 are affected. Much of the area is covered with advanced immature (about 60 to 75 years old) forest of variable density, composed mainly of white birch, western larch, Douglas-fir and lodgepole pine. These stands are, at best, of marginal merchantability but could provide some fuel wood or other minor forest products and perhaps a few small sawlogs.

Very little, if any, of this potentially impacted area is Crown land. Any loss of immature growing stock and productive forest land associated with the proposed developments would represent an insignificant portion of the total allowable annual cut for the study region.

Table 4.9

SUB-AREA 9: BILLY CREEK

Areas of Forest Capability Types Inundated
at Three Possible Reservoir Levels
(Hectares)

BCLI FOREST CAPABILITY CLASS	River to 424 m a.s.l.	424-427 m a.s.l.	CUMULATIVE TOTAL	427-430 m a.s.l.	TOTAL
1	-	-	-	-	-
2	-	-	-	-	-
3	12.0	1.0	13.0	1.0	14.0
4	4.0	3.0	7.0	3.0	10.0
5	2.0	1.0	3.0	1.0	4.0
6	-	-	-	0.5	0.5
7	-	0.5	0.5	0.5	1.0
TOTAL	18.0	5.5	23.5	6.0	29.5

These areas need not be permanently lost from the forest land base if the project proceeds. With suitable attention to reclamation planning it should be possible to restore an equivalent area of like or even improved capability after the project is completed. For the purposes of impact assessment, it is assumed that B.C. Hydro would reclaim this area to its original forest capability.

SUB-AREA 10: OASIS (Including the Murphy Creek Till Site)

Forest Cover and Timber Volumes Inundated

No areas of forest cover or timber volumes are inundated in sub-area 10 at any of the three reservoir levels examined.

Forest Capability Types Inundated

Most of the land which would be inundated in sub-area 10 at any proposed reservoir level is BCLI Class 3 or 4. Class 4 land is the most predominant at all three reservoir levels. A small area of Class 6 land is also included at all three levels (see Table 4.10). At the proposed reservoir level of EL 424 m, a maximum of 74 ha would be inundated. Since no timber stands are present and the land will not likely be managed for timber production in the future, no impacts on future timber resources are considered to exist in this sub-area, either from inundation or from clearing for the proposed damsite and associated works.

Table 4.10

SUB-AREA 10: OASIS

Areas of Forest Capability Types Inundated
at Three Possible Reservoir Levels
(Hectares)

BCLI FOREST CAPABILITY CLASS	River to 424 m a.s.l.	424-427 m a.s.l.	CUMULATIVE TOTAL	427-430 m a.s.l.	TOTAL
1	-	-	-	-	-
2	-	-	-	-	-
3	19.0	0.5	19.5	0.5	20.0
4	52.0	14.0	66.0	13.0	79.0
5	-	-	-	-	-
6	3.0	0.5	3.5	0.5	4.0
7	-	-	-	-	-
TOTAL	74.0	15.0	89.0	14.0	103.0

FORESTRY IMPACT EVALUATION

Murphy Creek Till Site

The Murphy Creek till site is considered to be relatively sensitive to exploration and open pit excavation, due to its undisturbed nature, diversity of forest types and topography.

The 17 ha pit site, and approximately 8 ha of access road will require clearing. This clearing will result in the loss of a total of some 25 ha of immature mixed wood forests. These forested areas are believed to contain aspen, birch, pine and block cottonwood trees ranging in age from 20 to 60 years.

Approximately 4 ha or about one-third of the total area required for the access road to the till site will be contained within the cleared portion of the existing gas pipeline right-of-way. This will serve to reduce the extent of clearing required to develop the site.

SUMMARY OF EFFECTS OF THE PROJECT ON THE STUDY AREA

Forest Cover and Timber Volumes Inundated

Some areas of forest cover are affected at all three reservoir levels considered (see Table 4.11), including 12.8 ha at the proposed level of EL 424 m. However, only a few areas have potentially merchantable stands. Nearly all of the areas are privately held lands which are not being managed for timber production.

Forest Capability Types Inundated

Land areas that would be inundated at the three reservoir levels considered, by BCLI forest capability class, are

Table 4.11

SUMMARY OF FOREST COVER INUNDATED AT THREE POSSIBLE RESERVOIR LEVELS[a,b]

SUB-AREA		River to 424 m a.s.l.		424-427 m a.s.l.		427-430 m a.s.l.		TOTALS	
NO.	NAME	Volume (m^3)	Area (ha)	Volume (m^3)	Area (ha)	Volume (m^3)	Area (ha)	Volume (m^3)	Area (ha)
1	Columbia River North	10	0.2	10	0.2	20	0.4	40	0.8
2	Columbia River South	6	0.04	5	0.03	3	0.02	14	0.09
3	Pass Creek	200	1.0	-	-	-	-	200	1.0
4	Kootenay River	-	-	-	-	-	-	-	-
5	Castlegar-Kinnaird	-	-	300	2.5	220	3.0	520	5.5
6	Castlegar Airport	-	-	-	-	-	-	-	-
7	Champion and Jordan Creeks	490	4.4	290	2.8	80	0.8	860	8.0
8	Blueberry Creek - Genelle	-	-	-	-	-	-	-	-
9	Billy Creek	40	7.2	4	0.6	1	0.2	45	8.0
10	Oasis	-	-	-	-	-	-	-	-
SUBTOTALS		746	12.8	609	6.1	324	4.4	1679	23.3
CUMULATIVE TOTAL		746	12.8	1355	18.9	1679	23.3		

[a]Volume estimates are net volumes at close utilization standards, less decay.

[b]EL 427 m and EL 430 m are no longer being considered, but are presented to illustrate comparative losses at the three reservoir operating levels initially assessed in the environmental studies.

summarized for the entire study area in Table 4.12. Class 4 lands comprise most of the potential inundation at all reservoir levels considered, followed by Class 3 lands. A total of 301 ha, 464.5 ha, and 628.5 ha, would be inundated, respectively, at the 424 m, 427 m, and 430 m reservoir levels.

Only a small part of the area under any of the three reservoir levels is presently occupied by forest cover and most of these stands are not adequately stocked with potentially commercial trees. None of the lands appears to be managed for timber production and existing land ownership patterns seem to dictate strongly against the forest resource potential of these lands ever being realized. Therefore it would be misleading to assess impacts on the basis of BCLI forest capability. Although the potential for timber production exists for much of the area potentially inundated, it is not in fact being realized at present and it does not appear that this will change in the future in the absence of the project.

FORESTRY VALUE OF AFFECTED AREAS

Maximum Forest Potential of Potentially Affected Areas

If all potentially affected lands within the study area were managed for timber production, which is totally unlikely, it is estimated that approximately 900 cubic metres per year of potential timber production would be lost at the 424 m proposed reservoir level. For the 427 m and 430 m reservoir levels this estimate would be 1700 and 2400 cubic metres per year, respectively.

At a $\$5/m^3$ stumpage rate, which represents a very generous estimate of potential stumpage, and a 10% discount rate, the

Table 4.12

STUDY AREA SUMMARY

Areas of Forest Capability Types Inundated at Three Possible Reservoir Levels[a] (Hectares)

BCLI FOREST CAPABILITY CLASS	River to 424 m a.s.l.	424-427 m a.s.l.	CUMULATIVE TOTAL	427-430 m a.s.l.	TOTAL
1	-	-	-	-	-
2	-	-	-	-	-
3	37.0	63.0	100.0	68.0	168.0
4	182.0	97.0	279.0	91.0	370.0
5	2.0	1.0	3.0	2.0	5.0
6	33.0	0.5	33.5	2.5	36.0
7	47.0	2.0	49.0	0.5	49.5
TOTAL	301.0	163.5	464.5	164.0	628.5

[a]EL 427 m and EL 430 m are no longer being considered, but are presented to illustrate comparative losses at the three reservoir operating levels initially assessed in the environmental studies.

maximum future production potential of all capable lands inundated at the proposed reservoir level has a present value of $45,000. The value of this future production potential is correspondingly higher at higher reservoir levels. It is stressed that these potential values lost would require all the lands inundated that had forest capability to be restored and managed as commercial forests. This scenario is not projected to occur.

Forest Potential of Potentially Affected Areas of Forest Cover

Alternatively, if only the production potential of all lands with mature or immature forest cover in the study area that are subject to possible inundation is considered, an estimated 60 cubic metres per year of potential timber production would be lost at the proposed 424 m reservoir level. Employing the same valuation assumptions as above, this production potential has a present value of $3,000. At the higher reservoir levels this value of future production potential is correspondingly higher.

Since most, if not all, lands in the study area are not in fact presently managed for timber production and are not expected to be in the future, both of the above examples overstate the project's actual impact on the study area's forestry potential. In the 1980 Forest and Range Analysis Technical Report (BCMF, 1980), lands in the study area are projected to be entirely unavailable for timber harvesting. Since lands affected by the project will not be available for timber production in the future, there should be no impact from the project on the study area's forestry potential.

Minor Forest Products

The loss of a few small stands which might provide some minor forest products, principally cordwood and possibly fence posts and rails, might be locally important to a few individuals. White birch firewood is locally in demand and reportedly sells for approximately $85.00 per cord. It is not possible to attribute a total value to these stands because such value is very much dependent upon site specific supply and demand conditions.

IMPACTS FROM A REGIONAL PERSPECTIVE

Allowable Annual Cuts and Timber Supply in the Region

Crown lands are the main source of timber supply in the study region. The total allowable annual cut (AAC) from Crown lands is 274,670 cubic metres (see Table 2.1). No figures are available showing the precise contribution of lands in the study area to the regional AAC. However, the small extent of study area forest resources indicates that it is negligible. Discussions with B.C. Ministry of Forests' regional staff enforce this impression.

The 900 cubic metres per year of potential timber production that could occur if all areas potentially affected at the proposed reservoir level of 424 m were managed for timber production represents, at best, less than one-third of one percent of the regional AAC, although it could constitute a large proportion of the annual wood requirements for some smaller mills in the region (see Table 2.2).

The maximum potential timber production of 60 cubic metres that would be lost from only those areas currently under forest cover that would be affected by the proposed project, represents an even smaller percentage of the regional AAC, although it may be significant to some small logging operations or mills, given the projected timber deficit for the region (see Chapter 2).

MITIGATION OPPORTUNITIES

Logging of the Reservoir Area

As discussed in the foregoing sections, most of the stands in all of the reservoir areas examined do not appear to offer a reasonable logging chance because of their scattered occurrence, small extent, low merchantable volumes per hectare, and generally low log quality. A possible exception is a very small, 1 ha stand of cottonwood in Sub-area 3. Whether or not this stand would constitute a reasonable logging chance would depend on timber quality, accessibility to markets for cottonwood logs and on arrangements for access across and to privately owned lands. With respect to the standing timber that would be lost if the project proceeds, commercial logging of the reservoir area does not appear to be an appropriate mitigation measure. However, clearing of the reservoir may be desirable as a mitigative measure from the viewpoint of aesthetics and recreation.

Firewood

Selling or giving away firewood to local residents could be considered. Firewood could be cut from some of the few mixed

stands of white birch, lodgepole pine, western larch and Douglas-fir which are scattered in the reservoir areas. No precise estimate of the amount of firewood which could be cut has been made, however the maximum amount is roughly estimated to be 100 cords at the proposed EL 424 m reservoir level.

Reclamation of Forest Areas

A reclamation plan should be prepared and implemented for any forest areas used for till or aggregate excavation. Crown lands should be reforested to suitable species following reclamation. Privately owned areas, such as the proposed aggregate excavation site at Billy Creek should be returned to private ownership after B.C. Hydro has terminated use and reclaimed the area so that it is suitable for reforestation.

APPENDIX A

TERMS OF REFERENCE

SECTION G

FORESTRY

(a) Inventory

Describe the forest resources in the study area, including existing timber volumes, species present, mean annual increments, growing site classes and CLI capability. The B.C. Forest Service cover map must be updated to allow for recent fires, logging, insect attacks and land alienations. The B.C. Forest Service data in the map area and map volume statements should be updated before use as one of the primary data sources. Determine the utilization of the resource including annual allowable cut, timber sales, tree farm licences, revenue, companies operating in the area, and types and sizes of milling operations.

(b) Effect of Development

Assess the value of any long term loss of forestry potential within the flooded area in terms of hectares and capability of forest land inundated and potential income lost. Discuss the importance of any loss to local and regional areas.

Determine the costs and benefits of logging the reservoir area.

APPENDIX B

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QUALITY

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